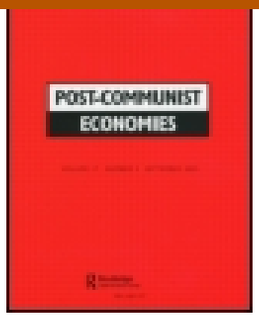

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The growth of farms: a Hungarian-Slovenian comparison

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ABSTRACT

This article describes an investigation of the relationship between farm size and the growth of farms. Theories about the association between farm size and the growth of farms give mixed results by country and over time. The former relationship is tested by assessing the validity of Gibrat's Law for Hungarian and Slovenian farms in the period 2007–2015. The use of a sample of farms from Farm Accountancy Data Network datasets makes it necessary to avoid biases due to heterogeneous structures across farming systems. Thus, we use quantile regressions to control for farm-size-related heterogeneity in the samples. Results suggest rejection of the validity of Gibrat's Law for farms in Hungary and to a lesser extent for Slovenian farms when the growth of farms is measured by growth of output per farm (where smaller farms grew faster than the largest farms), but not in the case of an increase in farm inputs (i.e. land and labour per farm). We provide evidence for Hungarian farms that smaller, mostly individual farms grew faster than larger, mostly corporate farms throughout the period of analysis.

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Farm size; farm growth; Gibrat's Law; quantile regression; Central and Eastern Europe

Introduction

The comparative analysis of farm size and its dynamics is of significant importance for research and farm policy because farm-size growth is one of the key research issues in relation to farming structures and farm restructuring, and has implications for rural factor markets and farm competitiveness. This fact motivated our research interest in generating comparative empirical evidence and better understanding the relationship between farm size and the growth of farms by employing the Law of Proportionate Growth, also called Gibrat's Law (1931). Gibrat's Law states that the rate of growth of a firm/farm is independent of its size and is thus determined by random factors. From an economic perspective, the violation of Gibrat's Law would mean that either smaller farms grow faster than larger ones, implying farm-size convergence, or that larger farms grow faster than smaller ones, thus suggesting divergence in farm growth. Not being able to reject Gibrat's Law would suggest no significant difference in size-dependent farm growth. It is important to characterise the relationship between the validity of Gibrat's Law and the economic driving forces that shape industry structure in the short term (economies of size) and in the long term (scale and scope economies) (Duffy, 2009; Hallam, 1991).

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In this paper, comparative analysis of the validity of Gibrat's Law for farms is described for two new and neighbouring European Union (EU) countries: Hungary and Slovenia. Hungarian agriculture has been transformed from a predominance of former large-scale state and cooperative farms into a dual farm structure with numerous smaller individual farms and a smaller number of larger corporate farms, including cooperative enterprises. Slovenian agriculture has always been predominantly under private ownership and operation. As attempts at communist collectivisation failed, cooperative farms were not important factors, while state farms were largely based on nationalised land which has now partly been restituted to former owners, and partly taken over by a special state fund (Bojnec & Swinnen, 1997). A relatively small number of privatised agricultural enterprises are now largely leasing land from this state fund. As in many other European countries, agriculture in Slovenia as well as in Hungary during recent years has undergone considerable structural change, with a decrease in the number of farms and an increase in farm size. One important question is whether these shifts have resulted in a change in farming structures that depends on the relationship between farm size and the growth of farms: namely, are these processes proportional, or is there any farm-size convergence or divergence?

More specifically, this paper contributes to the literature in the following four areas: first, it provides a comparative analysis of the validity of Gibrat's Law for two new neighbouring EU member states, Hungary and Slovenia. Second, in addition to an examination of the distribution of farm input (land and labour) size and output size measures for Hungarian and Slovenian farms, the duality of Hungarian farm structural change is tested, and the relationship between farm size and the growth of Hungarian and Slovenian farms is estimated and compared using quantile regressions and tests of the equality of regression coefficients by quantiles. Note that a duality in the former Western development and agricultural economics debate refers to the coexistence of two separate farming sectors within one country, between traditional small (peasant) and modern large (capitalist) farms, by different levels of development and technology used (Subrata, 2010). The duality in farming sectors in post-communist Central and Eastern European (CEE) countries as a different mix of family and corporate farms has occurred a result of de-collectivisation, restitution, and privatisation of former collective or cooperative farms and state farms, land reform, and farm restructuring (Kostov, Davidova, & Bailey, 2019; Lerman, Csaki, & Feder, 2004; Swinnen, Buckwell, & Mathijs, 1997; Yanbykh, Saraikin, & Lerman, 2019). The use of Hungarian and Slovenian Farm Accountancy Data Network (FADN) datasets makes it necessary to avoid bias related to heterogeneous structures across farming systems. Thus, we use quantile regressions to control for farm-size-related heterogeneity in the samples. Third, the paper describes a comparative analysis of the relationship between farm size and the growth of farms as applied to two transition Hungarian and Slovenian farming sectors that are characterised by rather different farm structures, thus has implications for rural factor markets, particularly in respect of the factors investigated: land and labour, and farm output competitiveness. Finally, the study contributes to the literature on farming structures and farm restructuring with implications for rural factor markets and farm competitiveness.

The following section provides the research background from a literature review and defines the gaps in the literature. Then, we present data and methods. This is followed by a results section that focuses on quantile regressions, and a discussion of the importance of our findings for science, policy, and practice. A final section concludes.

Literature review

Gibrat's (1931) Law on the proportional rate of growth of a firm/farm as independent of its absolute size suggests a distribution that is log-normal (Sutton, 1997). While there is a wealth of literature related to the testing of the validity of Gibrat's Law for manufacturing and service firms (Gardebroek, Turi, & Wijnands, 2010; Goddard, Wilson, & Blandon, 2002; Lotti, Santarelli, & Vivarelli, 2003; Ward & McKillop, 2005), only rarely have studies investigated the growth of farms. The latter studies have mostly been conducted in relation to the growth of farms in developed market economies (Upton & Haworth, 1987; Weiss, 1998, 1999) and have important implications regarding farm-size distribution (Wolf & Sumner, 2001), farming system diversity (Choisis, Thévenet, & Gibon, 2012), and comparative structural changes in farms in different countries (Zimmermann & Heckelei, 2012).

Akimowicz, Magrini, Ridier, Bergez, and Requier-Desjardins (2013) investigated different drivers of farm-size growth for south-western France, finding that farm structural characteristics, farmer's age, the existence of a successor, and spatial factors approximating urban influences had a particularly significant influence.

Brenes-Muñoz, Lakner, and Brümmer (2016) for German organic farms found that the growth of individual organic farms in terms of farm output growth in one of the fastest growing branches of agriculture in Germany was influenced by farm size, land, capital, soil quality, and the intensity of livestock production.

During the last three decades, the agricultural sector in transition CEE countries has undergone substantial structural change due to land reforms, and the privatisation and restructuring of agricultural and food-sector value chains. In addition, it has been exposed to liberalisation and the impact of integration into the European Single Market with its free movement of goods, capital, services, and labour within the EU. Nonetheless, evidence is lacking concerning recent structural changes in farms and agriculture in CEE countries. The previous literature has underlined farm privatisation and farm restructuring with evolving farm structures and land use patterns in former post-communist CEE countries (Lerman et al., 2004; Swinnen et al., 1997). However, there are rare studies and the evidence in the existing literature on farm growth with emerging structural changes in farms (Bojnec & Fertő, 2020). The paper aims to conceptualise the structural changes in farms with respect to the two economies in transition. Therefore, the research described in this paper was designed to investigate whether Gibrat's Law holds for farms in two CEE countries: Hungary and Slovenia.

Thus far, empirical findings about the validity of Gibrat's Law in terms of farm-size growth in CEE countries are mixed. Rizov and Mathijs (2003) for the samples of Hungarian individual farms found that farm growth decreases with farm age when farm size is held constant and learning considerations are important. Market and industry characteristics were also found important for growth rates of individual farms. Among recent empirical evidence, Bakucs and Fertő (2009) and Fertő and Bakucs (2009) investigated the validity of Gibrat's Law for the growth of Hungarian farms. They rejected the validity of Gibrat's Law if all farms (corporate, family, and individual) are considered together, regardless of the farm-size measure used. More specifically, they found that smaller Hungarian farms grew faster than larger ones.

Comparative analysis of the validity of Gibrat's Law for field crop and dairy farms in France, Hungary, and Slovenia produced mixed results (Bakucs, Bojnec, Fertő, & Latruffe,

2013). The validity of Gibrat's Law was mainly rejected for Hungarian farms, for French and Slovenian dairy farms, and, to a lesser extent, for French field crop farms. In these cases, smaller farms grew faster than larger ones, while the rate of growth of Slovenian field crop farms in terms of land was found to be independent of size.

Different methodological approaches have been applied testing the validity of Gibrat's Law. Bojnec and Fertő (2020) applied cross-sectional dependence test and four different groups of panel unit root tests. They confirmed the validity of Gibrat's Law for Slovenian farms independently from the measures of farm size and types of panel unit root tests. All farm sizes tend to contribute to an increase in average farm size.

The study addresses the analysis of the farm growth, which is conducted by an empirical approach using FADN data for Hungary and Slovenia in the perspective of testing the validity of Gibrat's Law. Our paper improves such analyses through the application of quantile regressions and adds to the literature the most recent evidence about the growth of farms, their patterns of structural change, and farm-size restructuring for Hungarian and Slovenian farms: important factors in the context of science, policy, and managerial practice. While testing for the validity of Gibrat's Law, the study provides significant evidence on the farm growth contrasting the two CEE countries, the types of farms and their legal status.

Data and methods

The empirical analysis is based on farm-level data from Hungarian and Slovenian FADN datasets. The time span of the unbalanced panel dataset used for the analysis is the period 2007–2015 for both countries under analysis. There is no single measure of farm size in agriculture, and research findings may differ according to the proxy that is used. This proxy mainly depends on farms' production specialisation and technology. We apply both farm-size measures: input farm size, and output farm size. The measurement of farm size using output value measures is subject to inflation and changes in relative prices. The FADN code SE005 is output value measure for the economic size of farm. Prior to 2010, output farm-size measure was expressed in European Size Units (ESUs), a standard gross margin whereby 1 ESU is equivalent to 1200 euros. Since the financial year 2010 onwards, the standard output (SO) expressed in 1000 euros per farm has been introduced as the economic size of farm. Data before 2010 are adjusted to SO. SO was deflated to euro at constant prices using the statistical indices of agricultural output prices. Physical input farm-size measures are often characterised by non-linear production technology and involve changes in the mix and proportion of inputs. Although statistics about input farm size generally refer to land in terms of utilised agricultural area (UAA in hectares) per farm, this indicator is often irrelevant for livestock farms. For this reason, in this paper farm input size is also measured as the amount of labour that is used: the number of full-time equivalent workers employed per year on the farm (in Annual Working Units, AWUs, 1 AWU represents 1800 hours per year), including both family and hired workers for both Hungarian and Slovenian farms. Thus, two input farm-size variables (hectares of UAA per farm and number of AWU per farm), and output in SO per farm are used. The three farm-size measures, both input and output, are derived for Hungary from around 1900 farms per year (1208 farms in the final sample), while for Slovenia for 1242 farms per year (259 farms in the final sample).

Equation (1) represents the stochastic process underlying Gibrat's (1931) Law:

$$\frac{S_{i,t}}{S_{i,t-1}} = \alpha S_{i,t-1}^{\beta_i - 1} \varepsilon_{i,t} \tag{1}$$

where $S_{i,t}$ and $S_{i,t-1}$ are the sizes of the *i*th farm in the period *t* and in the previous period *t*-1, respectively. $\varepsilon_{i,t}$ is the disturbance in period *t*, independent of $S_{i,t-1}$. α is the common growth rate of all farms, whilst β_1 measures the effect of initial size upon the given farm's growth rate.

If $\beta_1 = 1$, then growth rate and initial size are independently distributed, indicating that Gibrat's Law holds. If the coefficient is less than one, it follows that small farms tend to grow faster than large farms, while the opposite is the case if β_1 is greater than unity. Rewriting Equation (1) in the form represented by Equation (2) allows for the testing of the significance of the coefficient β_1:

$$\log S_{i,t} = \beta_0 + \beta_1 \log S_{i,t-1} + \mu_{i,t} \tag{2}$$

where $\beta_0 = \log\alpha$ and $\mu_{i,t} = \log\varepsilon_{i,t}$. Following Ward and McKillop (2005), if $\beta_1 = 1$ (i.e. if Gibrat's Law holds), then positive (negative) values of β_0 indicate growth (decrease) in average farm size. If, however, $\beta_1 < 1$, smaller farms tend to grow faster than larger ones.

Previous studies (Fertő, 2016; Lerman, 2001) highlighted that Hungary has a dual agricultural structure. Thus, we checked for structural change in terms of the legal forms of farms by employing a dummy (D) variable for legal form which takes the value of '1' if a farm is a corporate farm, and is otherwise '0':

$$\log S_{i,t} = \beta_0 + D_{i,t}\beta_2 + \beta_1 \log S_{i,t-1} + \beta_3 D_{i,t} \log S_{i,t-1} + \propto_{i,t} \tag{3}$$

where β_2 is the regression coefficient of legal form dummy and β_3 refers to the interaction term. In the OLS regression estimation, error terms are assumed to follow the same distribution irrespective of the value of the explanatory variables. Since we can only analyse surviving farms, estimations are conditional on survival (*conditional objects*, see Lotti et al., 2003). Therefore, in this paper, we use the quantile regression estimation technique. Following Lotti et al. (2003), the θth sample quantile, where $0 < \theta < 1$, can be defined as:

$$\min_{b \in R} \left[\sum_{i \in \{i: y_i \geq b\}} \theta |y_i - b| + \sum_{i \in \{i: y_i < b\}} (1 - \theta) |y_i - b| \right] \tag{4}$$

where y_i and b are estimated for any quantile in the range of zero and one.

For a linear model such as $y_i = \beta' x_i + \varepsilon_i$, the θth regression quantile is the solution of the minimisation problem, similar to Equation (4):

$$\min_{b \in R^k} \left[\sum_{i \in \{i: y_i \geq x_i b\}} \theta |y_i - x_i b| + \sum_{i \in \{i: y_i < x_i b\}} (1 - \theta) |y_i - x_i b| \right] \tag{5}$$

Solving Equation (5) for *b* provides a robust estimate of β. To obtain unbiased error terms, we use bootstrap methodology to estimate the variance-covariance matrix.

Results

Summary statistics

The summary statistics clearly indicate the difference in the size of farms between Hungary and Slovenia (Table 1). The Hungarian samples include the largest farms on average, and the Slovenian samples the smallest. Hungarian farms are on average much bigger than Slovenian farms both in terms of output produced (in SO per farm) and inputs used (labour and land per farm) due to the existence of particularly large corporate farms in Hungary. This is due to the different historical trajectories of the countries: while the Hungarian farming sector was almost fully collectivised during the communist era, this was not the case for the former Yugoslavia, including Slovenia, where small family farms prevailed. During the post-communist period, individual farms in Hungary were re-established, which, along with privatisation and the transformation of former large-scale state farms and collectivised cooperative farms, resulted in the dual farm structure which now exists in Hungary. Individual farms in Hungary in terms of output in SO per farm and land input in UAA per farm are around one-tenth the size of corporate farms. Therefore, corporate farms in Hungary according to size are much larger than individual farms in Hungary, and also are larger than most farms in Slovenia, which, except for a few privatised agricultural enterprises, are family farms. While on average there is greater size similarity between individual farms in Hungary and (largely) family farms in Slovenia, there are substantial absolute size differences between the smallest individual farms in Hungary (of a small minimum size) and the relatively large maximum sizes of the largest corporate farms. In spite of the fact that Hungarian individual farms and Slovenian mostly family farms are on average of a similar

Table 1. Descriptive statistics: farm-size variables for Hungary and Slovenia, 2007–2015.

	Output in SO (in euro at constant prices)	Land in UAA (in hectares)	Labour in AWU
Hungary			
Individual farms			
Mean	64.67	1.98	87.11
Median	33.63	1.37	47.50
Minimum	0.00	0.01	0.00
Maximum	2015.20	31.63	1659.89
Corporate farms			
Mean	641.68	19.48	647.27
Median	195.52	8.17	261.00
Minimum	0.00	0.09	0.00
Maximum	23,598.33	433.86	9650.73
Total farms			
Mean	179.48	5.46	198.57
Median	42.23	1.67	58.13
Minimum	0.00	0.01	0.00
Maximum	23,598.33	433.86	9650.73
Slovenia			
Total farms			
Mean	37.86	19.75	1.96
Median	20.09	13.18	1.75
Minimum	2.02	0.00	0.09
Maximum	1357.03	430.81	46.09

SO – standardised output, UAA – utilised agricultural area, and AWU – annual working units.
Source: Authors' estimations based on Hungarian and Slovenian FADN data.

size according to use of inputs (land and labour per farm), Hungarian individual farms produced almost twice as much output in terms of SO per farm. This difference in overall farm productivity and efficiency may potentially be explained by farm and production characteristics such as type of farming and farm specialisation, production technology, and quality of farm natural resources such as quality of land. Finally, while most of the Slovenian farms in the FADN sample are family farms, there are also a few agricultural enterprises whose roots are former state agricultural enterprises but which have now been privatised (except for some land that they typically rent from the state land fund) which represent outliers due to their large size.

Farm-size distribution

Figure 1 nicely illustrates the fact that farm inputs, land and labour, and output structures expressed in SO in Hungary are much more unequally distributed than in Slovenia: 20% of the largest farms in Hungary operated on more than three-quarters of UAA, employed a slightly higher share of labour on farms (close to 80%), and produced more than 80% of output as expressed in SO. Comparatively, in Slovenia the shares for the 20% of the largest farms are much smaller: they operated on more than 50% of UAA, employed less than 40% of labour on farms, and produced slightly less than 60% of output as expressed in SO. Consequently, all other smaller sized farms in Slovenia are relatively more important in terms of farming land and labour input structures and farm output structures than in Hungary.

Figure 1. Distribution of farm-size measures in Hungary and Slovenia, 2007–2015.

Testing for structural change

Duality in Hungarian farm structure was tested as structural change in terms of the legal form of farms, using the dummy D for legal form and its interactions with farm-size measures. We find that legal dummy D is significant only for land size. This finding is also supported by the regression coefficient β_3, which is significantly positive (Table 2) for land and also for labour. Wald tests show that we can reject the null hypothesis of coefficients, including the suggestion that legal dummy D is jointly zero for labour and land. In sum, we conclude that we can observe structural changes between corporate and individual farms in terms of labour and land size in Hungarian agriculture.

Quantile regression

Figure 2 presents quantile regression estimates and the coefficients of ordinary least squares (OLS) along with 95% confidence intervals for the total sample of Hungarian

Table 2. Testing for structural change in Hungarian farms, 2007–2015.

		Standardised output	Labour	Land
Constant	β_0	1.149***	0.147***	0.249***
(log $S_{i,\ t-1}$)	β_1	0.950***	0.812***	0.941***
Legal dummy (D)	β_2	0.104	0.087	−0.448***
Dx(log $S_{i,\ t-1}$)	β_3	−0.002	0.068*	0.069**
H0: D = 0, Dx(log $S_{i,\ t-1}$) = 0		0.2736	0.0012	0.0216
Determination coefficient (R^2)		0.799	0.763	0.881
Number of observations (N)		1245	1245	1196

*significant at 10%; **significant at 5%; ***significant at 1%

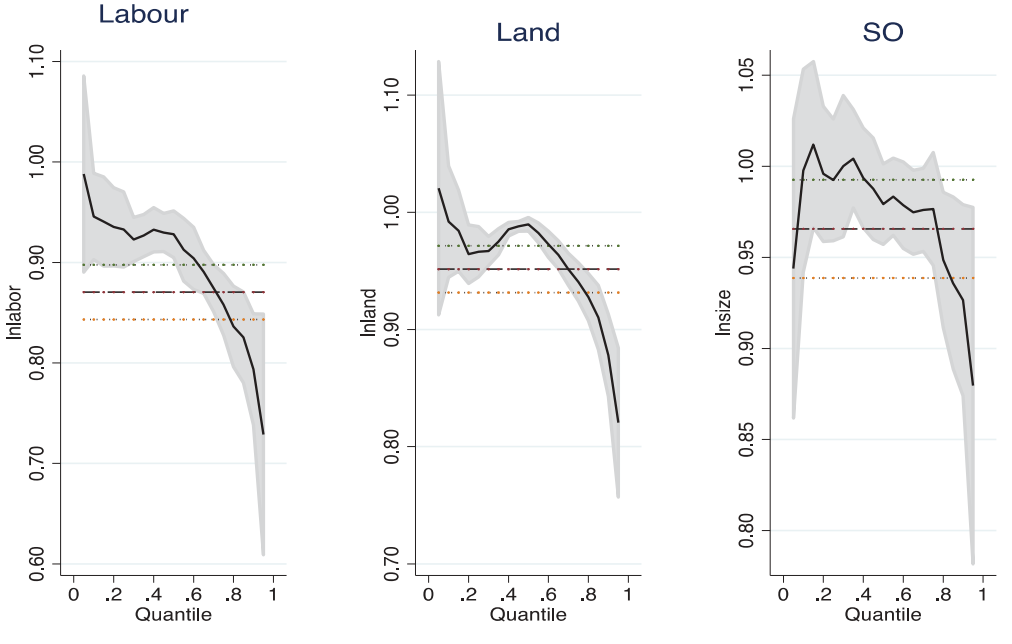

Figure 2. Quantile regression for total sample in Hungary, 2007–2015.

farms by different size variables. It can be seen that the β_1 confidence interval is well below '1' across all quantiles except for output in SO, supporting rejection of the validity of Gibrat's Law. The logarithmic value of Hungarian farm-size variables consistently declines independent of the increase in quantiles from 0 to 1. The coefficients of OLS estimates are less than '1' for all size measures.

Figure 3 shows that the β_1 confidence interval includes '1' across all quantiles for land, the lowest and highest quantiles for labour, and upper quantiles for output in SO, thereby supporting the validity of Gibrat's Law for Slovenian farms. The coefficients of OLS estimates are below '1' for Slovenian farms, except for land. In general, the logarithmic value of Slovenian farm-size variables rose with an increase in quantiles from 0 to 1. The magnitude of change is smaller for labour and land farm size, but bigger for output farm size as expressed in SO. In the latter case, a particularly rapid increase is seen for quantiles 0–0.2, with a steady and substantial increase (growth) for quantiles 0.2–0.8, and a substantial decline for quantiles 0.8–1.

Moreover, both input farm-size measures (i.e. labour and land per farm) for Hungary were analysed and compared by farm organisational form: individual or corporate farm. Figure 4 illustrates the quantile regressions for labour farm size, which tends to decline for both organisational forms. The OLS coefficients are below '1' for both farm types. The coefficient interval of β_1 captures '1' only for the lowest quantiles for both individual and corporate farms, implying the need to reject the validity of Gibrat's Law for the majority of the distribution of the initial size of farms.

Considerable difference may also be observed in the shape and slope of curves of the quantile regressions between Hungarian individual and corporate farms (Figure 5). The confidence interval of OLS estimates is below '1' for individual farms, whilst it includes '1' for corporate farms. Despite the different shapes of the quantile estimates by farm type,

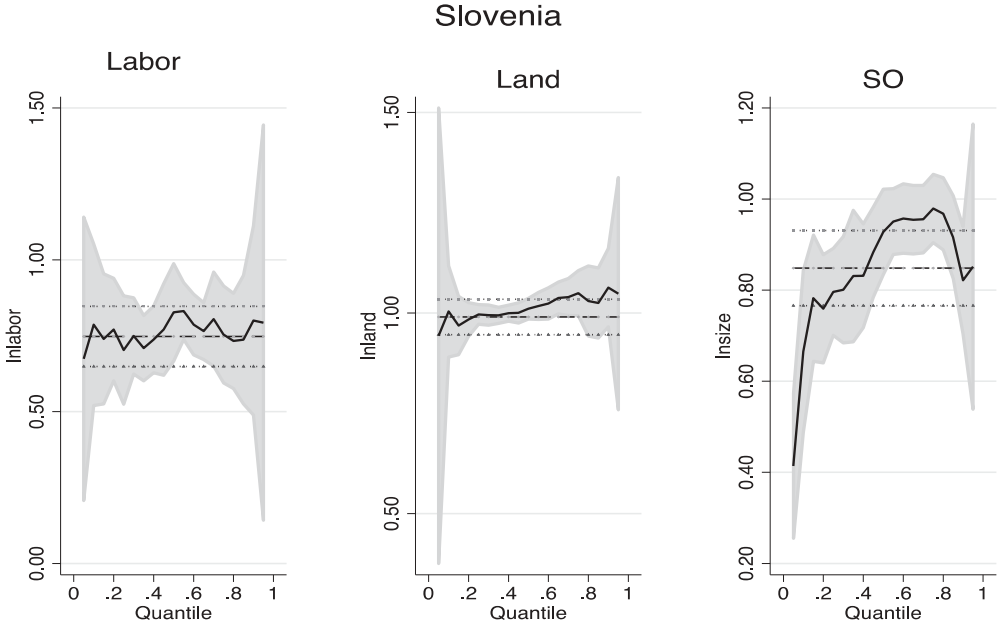

Figure 3. Quantile regression for total sample in Slovenia, 2007–2015.

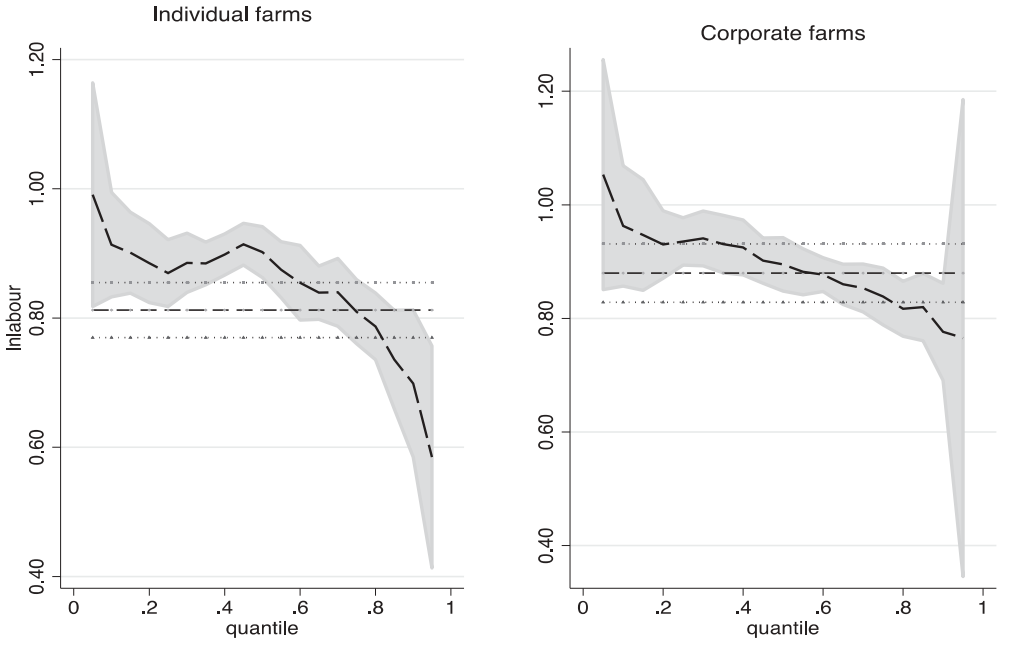

Figure 4. Quantile regressions for labour in Hungary, 2007–2015.

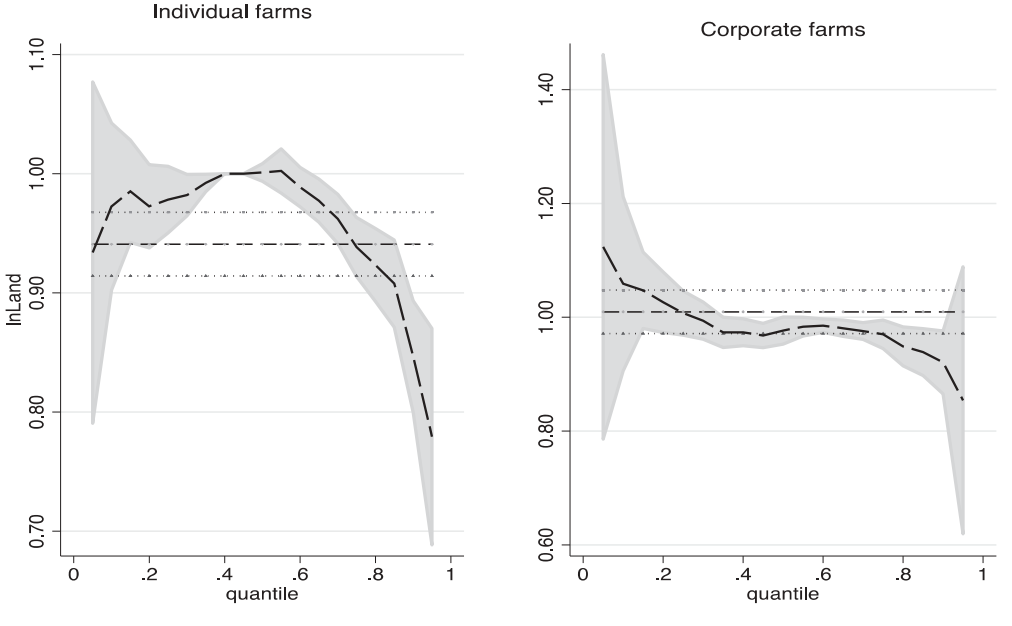

Figure 5. Quantile regressions for land in Hungary, 2007–2015.

interpretation of the results is rather similar. Confidence intervals capture '1' in the first half of the quantiles for both farm types, and the coefficient in the upper quantiles is below '1.'

These results imply that Gibrat's Law is valid for smaller sizes of individual and corporate farms, whilst larger farms increase proportionally less independently of their legal forms.

Equality test

We employed Wald tests to check equality regression coefficients by quantiles (Table 3). For Hungarian farms, except for land per farm on corporate farms, the absolute value of the test statistic (p-value) is smaller than the critical value at the 0.05-significance level. Accordingly, we cannot reject the null hypothesis that the regression coefficients are different.

In addition, we also checked whether $\beta_1 = 1$ at the median, with mixed results using the Wald test (Table 4). This is particularly the case for farm output size of SO in individual and corporate farms, but not for the sample as a whole, nor for land per farm on individual farms and for the sample as a whole. In the aforementioned cases, the p-value is greater than the critical value at the 0.05-significance level. Thus, we can reject the null hypothesis and conclude that the regression coefficients are different.

However, in the case of Slovenian farms, except for farm output size in SO the p-value is greater than the critical value at the 0.05-significance level. So, we reject the null hypothesis and conclude that the regression coefficients are different. This finding for Slovenian farms is further strengthened when testing $\beta_1 = 1$ at the median.

Discussion

The research for this paper involved performing quantile regressions on Hungarian and Slovenian FADN datasets to study the validity of Gibrat's Law in terms of the relationships between farm size and the growth of farms. In addition, structural changes in the legal forms of Hungarian farms (individual vs. corporate farms) were also examined.

Table 3. Testing equality of regression coefficients by quantile (p-values).

	Standardised output	Labour	Land
Hungary			
Full sample	0.0300	0.0000	0.0000
Individual farms	0.0069	0.0172	0.0000
Corporate farms	0.0367	0.0023	0.2756
Slovenia			
Full sample	0.0035	0.0907	0.9469

A Wald test shows the probability of the following null hypothesis (H_0): equality of the coefficients from quantile (q) regression when: q = 0.10, q = 0.25, q = 0.50, q = 0.75, and q = 0.90

Table 4. Testing $\beta_1 = 1$ at the median.

	Standardised output	Labour	Land
Hungary			
Full sample	0.0000	0.0000	0.0577
Individual farms	0.7896	0.0000	0.7142
Corporate farms	0.3230	0.0000	0.0000
Slovenia			
Full sample	0.0006	0.6061	0.4931

The Wald test shows the probability of the following H_0: size at the beginning of period (2007) = 1

The results suggest rejection of the validity of Gibrat's Law for Hungarian farms, and, to a lesser extent, for larger Slovenian farms measured by the growth of farm output in SO. Results for Hungarian farms clearly reject the validity of Gibrat's Law independent of whether farm size is measured in the form of prices evaluated as output expressed in SO, or as physically expressed agricultural inputs in terms of labour (AWU) and land (UAA). The evidence suggests that smaller Hungarian farms grew faster than larger ones over the period of analysis (2007–2015). Thus, our results are in line with the trends for the period 2004–2008 identified by Bakucs et al. (2013).

Due to the dual Hungarian farming structure, large corporate farms might already be too large to grow further, while the faster growth of smaller farms compared to larger ones may be explained by the transition in agriculture during the last three decades. During the communist era, the existence of individual farms in Hungary was inconsistent with the system, although later agricultural reforms that came with land reform and land restitution re-established the conditions for the setting up of individual farms and their growth in size. As a result, smaller farms, which are largely individual ones, grew faster than larger ones, which are largely corporate farms with their roots in privatisation and the restructuring of once large-scale state farms and agricultural cooperative enterprises that occurred during the transition from socialist collective farming (Gardner & Lerman, 2006).

In contrast, the history of the development of Slovenian individual or family farms involved the failure of the communist collectivisation process, but during the era of the latter system the size, growth, and operation of individual farms were constrained by legal, institutional, marketing, and some other limiting conditions (Bojnec & Swinnen, 1997). The confirmed more recent farm-size growth, irrespective of size, can be explained by the fact that Slovenian farms, in comparison to those of several other European countries, are still relatively small. Even the few larger farms in Slovenia are much smaller than those in Hungary; this is the case for most corporate farms. However, farm-size growth in Slovenia slightly varies depending on how farm size is measured. Growth of farms may be due to growth in physical input size (land and labour) and output growth. However, the growth of farm output value depends not only on the growth in the physical output of a product (extensive growth) but can be also due to changes in the structure of production and sales diversification, and related (higher) output prices (intensive growth). This may explain the conclusion for Slovenian farms that Gibrat's Law cannot be rejected for land and labour, as the growth of farm inputs is observed for all farm-size structures and is thus independent of input size. As all farm input structures are relatively small, this extensive input growth can also be expected in the future. However, the validity of Gibrat's Law for Slovenian farms cannot be fully rejected in the case of the growth of farm output in SO because smaller Slovenian farms increased output faster than the largest farms (of between quantiles 0.8 and 1, which captures the biggest family farms and mostly agricultural enterprises). This finding suggests both growth in farm-size physical output and the process of on-farm diversification, particularly on smaller, intensive family farms. As noted by Rivaroli, Ghelfi, Bertazzoli, and Piorr (2017) for Emilia-Romagna in Italy, growth of farm output depends on increasing productivity, the intensity of agricultural production, and the adoption of different on-farm diversification strategies in relation to farming system and type of farming (broadening strategies on arable farms, deepening and diversification strategies on intensive farms, and the combined strategies of specialised adopters of quality schemes). Multifunctionality and farm income diversification also have a historical tradition on

Slovenian farms and in Slovenian farm households, irrespective of different institutional environment and political systems over time (Bojnec, 2017; Bojnec & Fertő, 2013).

Finally, in addition to contributing to the science of analysis, these findings are also important in the context of policy and managerial practice. On the one hand, the occurrence and the extent of the growth of farms may be driven by different conditions related to farm and rural factor markets such as land and labour markets, and farm output markets. Different patterns of growth of farms could lead to changes in farm structures which may also be influenced by policy measures, particularly by agricultural and rural development subsidies. On the other hand, farm size and the growth of farms could be of significant relevance to farm efficiency and competitiveness as a means of improving managerial practices through changing the scale of farm operations either with farms' own hired (labour) or rented (land) agricultural and rural factor market resources.

Conclusion

This paper contributes to the analysis of the relationship between farm size and the growth of farms. Three farm-size measures were used: land (in terms of ha of UAA per farm), labour (AWU per farm), and output (SO per farm). The validity of Gibrat's Law was tested for samples of Hungarian and Slovenian FADN farms. Quantile regressions were applied with additional testing for structural changes in terms of the legal form of farms (individual and corporate farms in Hungary, while in Slovenia most farms are individual- or family-owned and operated farms).

Empirical results confirm that Gibrat's Law for Hungarian farms may be rejected as it is invalid independent of measures of farm size. More specifically, smaller farms in Hungary have grown faster than larger ones. The path of growth of farms differs between individual and corporate farms. Despite this, the results imply convergence in farm size between both organisational forms of the farm, while absolute differences in farm size have remained large. In terms of the size of Hungarian farms, individual farms are largely small farms and corporate farms are usually large farms.

The validity of Gibrat's Law for Slovenian farms cannot be rejected when farm size is measured according to the size of inputs per farm; i.e. land and labour. This finding suggests that there has been the growth of land and labour on surviving farms that is independent of size. As the number of farms has declined and their average size, particularly in terms of land, has increased, so have there been changes in Slovenian agricultural factor markets, with a concentration of land in a smaller number of farms and farm job creation for family jobs and hired, particularly seasonal, jobs (Unay-Gailhard & Bojnec, 2019). However, Gibrat's Law cannot be fully rejected for farm output growth in terms of SO, which is faster on smaller than on the largest Slovenian farms.

Unlike in Hungary, where there are larger absolute differences in farm size between smaller and larger farms, absolute farm-size difference is much smaller in Slovenia where convergence in farm size between smaller and larger farms may be an issue in the future long-term agricultural and rural development (such as that aimed at fostering economic, social, environmental, cultural, and other potential sustainability objectives). As some of these objectives are already covered by agricultural and rural development policies, such as agri-environmental measures and green jobs for farms and rural areas, one issue for further research is the role of subsidies in the growth of farms and farm restructuring and

sustainable farming and rural development, as well as the role of farm-specific characteristics and other potential drivers of the growth of farms.

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